CLAIMS

1. A method of providing synchronized clock signals at "n" distributed nodes in a synchronous system, the nodes comprising a master node and a plurality of slave nodes interconnected by first and second propagation channels, comprises the steps of:

at the master node,

(i) generating a first pulse train and a second pulse train each being regular and having a period (T),

(ii) propagating the first pulse train around the plurality of slave nodes via the first propagation channel;

(iii) propagating the second train of pulses around the plurality of slave nodes via the second propagation channel such that the pulses of the second train of pulses arrive at respective ones of the plurality of nodes in reverse order to the pulses of the first pulse train; and

(iii) maintaining the rate of each of the first and second pulse trains such that there are "pn" pulses in each propagation channel at any time, where "n" is the number of nodes, including the master node, and "p" is an integer, the pulses of the first train of pulses arrive at respective ones of the plurality of slave nodes substantially simultaneously, and the pulses of the second train of pulses arrive at respective ones of the plurality of slave nodes substantially simultaneously; and

at each of the slave nodes,

(iv) detecting arrival at a predetermined detection point of a pair of pulses, the pair comprising one pulse from each of the first pulse train and the second pulse train; and

(v) generating a clock signal event in dependence upon the pair of pulses both arriving at the detection point with a phase difference below a preset level.

2. A method according to claim 1, further comprising, at each slave node, the step of adjusting delays in each propagation channel, when the pairs of pulses in the two channels do not arrive with the required phase difference, so as to reduce phase differences between subsequently-arriving pairs of pulses, the arrangement being such that, when each of the slave nodes is generating clock signal events, the propagation time

between respective detection points of each pair of adjacent nodes is equal to the propagation time between respective detection points of each other pair of nodes.

3. A method according to claim 2, in a system having delay units in each propagation channel at each of the slave nodes, each delay unit comprising a pre-delay unit disposed upstream of the detection point and a post-delay unit disposed downstream of the detection point, wherein the step of adjusting the delays is effected such that any increment in a pre-delay is compensated by an equal decrement in the post-delay disposed in the same propagation channel, and vice versa.

4. A method according to claim 3, wherein, at each slave node, increments and decrements to a pre-delay in one of the propagation channels are accompanied by equal decrements and increments, respectively, to the post-delay in the other of the propagation channels.

5. A method according to claim 3, wherein the adjustments to the pre-delay unit and post-delay unit of a particular node are not the same as adjustments to the pre-delay and post-delay of others of the slave nodes.

6. A method according to claim 1, wherein the step of maintaining the pulse rate comprises the step of dividing the frequency of the first and second pulse trains by an integer multiple of the number of nodes, to produce a third pulse train at a lower frequency, propagating the third pulse train around the nodes via a third propagation channel substantially identical to the first and second propagation channel, and adjusting the rate of the first and second pulse trains to maintain a predetermined phase relationship between third pulse train pulses entering the third propagation channel and third pulse train pulses leaving the third propagation channel.

7. Apparatus for providing synchronized clock signals at "n" distributed nodes in a synchronous system, the apparatus comprising a master node unit and a plurality of slave node units interconnected in series by first and second propagation paths, the master node unit comprising:

pulse generation means for providing a first pulse train and a second pulse train, the pulse trains each being regular and both having the same period;

means for propagating the first pulse train around the slave nodes via the first propagation channel and the second pulse train around the slave nodes via the second propagation channel; and

means for maintaining the rate of the first pulse train and second pulse train such that, at any instant, there are "pn" pulses in each propagation channel, where "n" is the number of nodes, including the master node, and "p" is an integer; and such that the pulses of the second pulse train arrive at respective ones of the plurality of nodes substantially simultaneously and the pulses of the first pulse train arrive at respective ones of the plurality of nodes substantially simultaneously, but in reverse order to the first pulse train ;

each of the slave node units comprising:

detection means for detecting arrival at a predetermined detection point of a pair of pulses comprising one pulse from each of the first pulse train and the second pulse train, respectively, and generating a clock signal event in dependence upon the phase difference between the pair of pulses being less than a preset level.

8. Apparatus according to claim 7, wherein each slave node unit comprises adjustable delay units disposed in each propagation channel and means responsive to phase differences between the pairs of pulses being greater than the preset level for adjusting the delay units so as to reduce phase differences between subsequently-arriving pairs of pulses, the arrangement being such that, when the pairs of pulses have substantially no phase difference, each propagation channel segment between a pair of adjacent ones of the nodes provides the same propagation delay as every other propagation channel segment between a different pair of adjacent nodes.

9. Apparatus according to claim 8, wherein the adjustable delay units each comprise a pre-delay unit disposed upstream of the detection point and a post-delay unit disposed downstream of the detection point, and each slave node further comprises means for adjusting the duration of the pre-delay unit and post-delay unit such that any increment in the pre-delay unit is compensated by an equal decrement in the post-delay disposed in the same propagation channel, and vice versa.

10. Apparatus according to claim 8, wherein the adjusting means adjusts pre-delay units and post-delay units in both propagation channels, such that increments and decrements to a pre-delay in one of the propagation channels are accompanied by equal decrements and increments, respectively, to the post-delay in the other of the propagation channels.

11. Apparatus according to claim 8, wherein each of the pre-delay units and post-delay units comprises a plurality of delay elements and means for increasing the number of delay elements active in one of the delay units and decreasing the number of active delay elements in the other of the delay units correspondingly.

12. Apparatus according to claim 8, wherein each detection means comprises a phase/frequency device that provides an error signal proportional to the phase difference between the pair of pulses from the first and the second pulse trains.

13. Apparatus according to claim 12, further comprising means responsive to the error signal for controlling the adjustable delay units.

14. Apparatus according to claim 8, wherein the means for maintaining the pulse rate comprises means for dividing the frequency of the first and second pulse trains by an integer multiple of the number of nodes, to produce a third pulse train at a lower frequency, means for propagating the third pulse train around the nodes via a third propagation channel substantially identical to the first and second propagation channel, means for detecting phase relationships between third pulse train pulses entering the third propagation channel and third pulse train pulses leaving the third propagation channel, and means for adjusting the rate of the first and second pulse trains to maintain a predetermined said phase relationship.

15. Apparatus according to claim 8, wherein the propagation channels linking the detection means at the different nodes are provided by a single propagation path.

16. Apparatus according to claim 15, wherein the propagation path is electrical in nature.

17. Apparatus according to claim 15, wherein the propagation path is optical in nature.

18. Apparatus for synchronizing arrival times at a detection point of pulses in two pulse trains traversing the detection point in opposite directions, the apparatus comprising a plurality of delay units, comprising first pre-delay means and first post-delay means disposed prior to, and following, respectively, the detection point in a first propagation channel whereby pulses of the first train traverse the detection point, second pre-delay means and second post-delay means disposed prior to, and following, respectively, the detection point in a second propagation channel whereby pulses of the second train traverse the detection point, detection and control means for detecting phase differences between pulses from the first and second pulse trains and, responsive thereto, adjusting the delay units selectively so as to reduce the phase differences to below a preset level.